

*United States Marine Corps
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Marine Corps University
3070 Moreel Avenue
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Quantico, Virginia 22134-5068*

Master of Operational Studies

TITLE
DEVELOPING A COMBINED LETHAL AND NON-LETHAL CAPABILITY
FOR THE INDIVIDUAL MARINE

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF OPERATIONAL STUDIES

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AY 09-10

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Date: _____

Report Documentation Page		Form Approved OMB No. 0704-0188
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.		
1. REPORT DATE 2010	2. REPORT TYPE	3. DATES COVERED 00-00-2010 to 00-00-2010
4. TITLE AND SUBTITLE Developing a Combined Lethal and Non-Leathal Capability for the Individual Marine		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER	
	5e. TASK NUMBER	
	5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Marine Corps University,School of Advanced Warfighting,3070 Moreel Avenue,Quantico,VA,22134-5068		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited		
13. SUPPLEMENTARY NOTES Thesis. QUOTATION FROM, ABSTRACTION FROM, OR REPRODUCTION OF ALL OR ANY PART OF THIS DOCUMENT IS PERMITTED PROVIDED PROPER ACKNOWLEDGEMENT IS MADE.		
14. ABSTRACT The United States Marine Corps should research, develop, and field a new weapon that provides both a lethal and non-lethal capability for the individual Marine. Discussion: The future of military conflict will include a cluttered battlefield mixed with both enemy combatants and civilian non-combatants. The United States has achieved dominance in weapons development and conventional fighting capabilities, but has uncovered a dilemma when facing enemies in a complex irregular warfare environment. Enemy fighters who cannot match the United States in a traditional head-to-head battle have resorted to using innocent civilians as human shields, hiding among the populace, and exploiting civilian casualties to the benefit of their cause. In the future, individual Marines should be armed with a non-lethal capability to mitigate this enemy advantage. Current and emerging non-lethal technology offers the potential to better-equip Marines in the future and provide them with more flexibility to accomplish their assigned missions. The Active Denial System is one such technological concept and uses directed microwave energy to cause intensive skin heat against its intended target. This counter-personnel heating effect forces its target to move away from the directed energy beam. By leveraging this concept and applying it to an individual weapon, it will be possible to arm Marines with a directed energy weapon that includes both a lethal and non-lethal effects against a future target. Researching and fielding a non-lethal capability to reduce civilian casualties should be the focus of future individual weapons development. Conclusion: Future warfare will likely be more complex than previous conflicts. Active Denial System technology and concepts can be applied to the future development of individual weapons. Developing and fielding a directed energy weapon for the individual Marine that provides both lethal and non-lethal effects is a capability that is needed now and should be technologically possible to achieve.		

15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	Public Release	19	

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EXECUTIVE SUMMARY

Title: Developing a Combined Lethal and Non-Lethal Capability for the Individual Marine

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Thesis: The United States Marine Corps should research, develop, and field a new weapon that provides both a lethal and non-lethal capability for the individual Marine.

Discussion: The future of military conflict will include a cluttered battlefield mixed with both enemy combatants and civilian non-combatants. The United States has achieved dominance in weapons development and conventional fighting capabilities, but has uncovered a dilemma when facing enemies in a complex irregular warfare environment. Enemy fighters who cannot match the United States in a traditional head-to-head battle have resorted to using innocent civilians as human shields, hiding among the populace, and exploiting civilian casualties to the benefit of their cause. In the future, individual Marines should be armed with a non-lethal capability to mitigate this enemy advantage. Current and emerging non-lethal technology offers the potential to better-equip Marines in the future and provide them with more flexibility to accomplish their assigned missions. The Active Denial System is one such technological concept and uses directed microwave energy to cause intensive skin heat against its intended target. This counter-personnel heating effect forces its target to move away from the directed energy beam. By leveraging this concept and applying it to an individual weapon, it will be possible to arm Marines with a directed energy weapon that includes both a lethal and non-lethal effects against a future target. Researching and fielding a non-lethal capability to reduce civilian casualties should be the focus of future individual weapons development.

Conclusion: Future warfare will likely be more complex than previous conflicts. Active Denial System technology and concepts can be applied to the future development of individual weapons. Developing and fielding a directed energy weapon for the individual Marine that provides both lethal and non-lethal effects is a capability that is needed now and should be technologically possible to achieve.

Introduction

The United States faces a future of military operations fought in a complex irregular warfare environment. Unmatched weapons development and maneuver warfare capabilities of the United States have caused enemy forces to seek areas where they can exploit weaknesses in these dominant military capabilities. Specifically, enemies of the United States often seek asymmetric advantages by operating among civilian non-combatants. By blurring the lines between enemy fighters and the civilian population on the modern battlefield, a dilemma exists that requires a non-lethal capability in order to achieve desired military and political goals. In both Iraq and Afghanistan, civilian casualties (CIVCAS) have significantly limited the employment of lethal solutions at the tactical level due to the operational and strategic ramifications of killing non-combatants. *The United States Marine Corps should research, develop, and field a new weapon that provides both a lethal and non-lethal capability for the individual Marine.*

General Stanley A. McCrystal, International Security Assistance Force (ISAF) Commander in Afghanistan, stated in his August 2009 initial assessment letter to Defense Secretary Robert M. Gates, “to protect the population from harm, ISAF must take every practical precaution to avoid CIVCAS and collateral damage.”¹ In fact, he viewed the CIVCAS problem as being so significant from the standpoint of losing the trust of the Afghan population that he also rewrote the ISAF Counterinsurgency (COIN) guidance and issued a new tactical directive regarding the employment of kinetic weapons when balanced against the possibility of CIVCAS in Afghanistan.² Put simply, General McCrystal saw the need to limit the lethal options of his forces at the tactical level because he realized that gaining and maintaining the trust and confidence of the Afghan population was a greater requirement than killing enemy combatants.

Problem

United States and Coalition forces lack an effective non-lethal weapons capability that reduces possible collateral damage to civilians and still allows them to aggressively attack the enemy. Rather than disengaging from contact with the enemy, friendly forces should be armed with a variety of potential solutions, both lethal and non-lethal.

Background

In December 2002, the Defense Department's Joint Requirements Oversight Council (JROC) issued a Mission Need Statement advocating for greater non-lethal capabilities, which stated, "The U.S. military lacks the ability to engage targets that are located or positioned such that the application of lethal, destructive fires are prohibitive or would be counter-productive to the U.S. objectives and goals."³ The JROC Mission Need Statement was cited as part of an Independent Task Force study at the Council on Foreign Relations that addressed non-lethal capabilities. The identified requirement is not new. Since 1997, the Commandant of the Marine Corps has served as the Executive Agent to the Secretary of Defense for Non-Lethal Weapons, and he established the Joint Non-Lethal Weapons Directorate (JNLWD) in Quantico, Virginia. Currently, the JNLWD is actively pursuing non-lethal capability sets based on two groups of tasks: 1) Counter-personnel tasks; 2) Counter-material tasks.⁴ Although some progress has been made regarding non-lethal weapons development, few systems have been actively fielded for use by deployed combat units since the issuance of the JROC Mission Need Statement in 2002, especially en masse.

The 2004 Council on Foreign Relations Independent Task Force identified a significant lack of funding for non-lethal weapons and advocated for a nearly seven-fold increase in the Department of Defense budget for this program; the task force recommended increasing from a

FY04 appropriation of \$43.4 million up to \$300 million. The average budget appropriation in the first seven years of the program was only \$22 million.⁵ In an era where annual Defense Department budgets are over \$450 billion, the current appropriation clearly seems to lack a level of seriousness relative to the stated requirement. If civilian casualties on the modern battlefield are to be reduced, the Department of Defense must apply greater fiscal support to the non-lethal weapons program.

Solution

JNLWD should seek to develop a non-lethal capability for the individual Marine. The 1960's futuristic television show *Star Trek* found its characters armed with a weapon called a Phaser, which had two settings for engagement of human targets – one setting was “Kill” the other was “Stun.” Currently, individual Marines are armed with rifles and pistols that only offer kinetic solutions; they are trained in “shoot – no shoot” scenarios. If the current service rifle of the Marine Corps could be replaced with a capability which included a non-lethal setting – “Stun” – the ability to reduce the number of CIVCAS incidents in a future warfare environment would be significantly improved. Leveraging existing concepts and adapting them to individual weapons, the ability to bring non-lethal effects against enemy targets should not require a leap of imagination that is beyond the realm of the possible.

Existing non-lethal concepts

JNLWD has already developed and conducted limited employment of a capability called the Active Denial System (ADS).⁶ Using directed microwave energy to cause intensive skin heating, ADS engages human targets by directing a microwave energy beam against an individual or group. It causes significant discomfort against the target and requires them to move away from the directed beam. This non-lethal capability has been employed in testing

environments, as well as combat operations in Iraq, and has proven itself worthy of future development.⁷

ADS was initially fielded and mounted as a large box on the back of a Logistics Vehicle System (LVS) truck. It has been further developed and reduced in size to fit on a High Mobility Multi-purpose Wheeled Vehicle (HMMWV). Similar to the historic development of computers, which went from filling a large room to modern-day hand-held devices, ADS has already gone from a large, unwieldy system, to a more practical and user-friendly capability. According to the JNLWD web site, “Researchers are working on developing advances in technology...to be scaled to different sizes for different applications (i.e. hand-held).”⁸

Applying the ADS concept

A non-lethal capability can be developed using the concept of directed energy and employed by individual Marines. Although ADS uses directed microwave energy to cause skin heating, the ADS concept can be applied to develop a capability that temporarily stuns, disorients, or knocks out a human target. This provides the individual Marine with the required non-lethal capability. The ADS concept can also be applied to develop a directed energy capability that is *lethal*, allowing for the replacement of bullets by high-intensity lethal directed energy.

The Marine Corps should integrate this new capability to the next generation of the individual service rifle. The best way to cause the least disruption to existing skills and training would be to ensure the new directed energy weapon is as similar to the existing service rifle as possible (i.e. weight, length, sighting system, etc). The true end state of this concept is to develop a weapon that replaces the rifle selector switch options of “Safe, Fire, Burst” with a new switch that includes options of “Safe, Stun, Kill.”

The development of and transition to a new directed energy individual weapon must be balanced against the ongoing requirement to ensure Marines maintain their ability to have lethal effects against enemy targets. Non-lethal effects from a new weapon should be additive to, not exclusive from, the lethal capability. Within these parameters, the next generation of individual weapons can be developed. Arming individual Marines with “Stun-Kill” options will greatly increase their flexibility.

As an example, imagine a future combat scenario where a rifle platoon is tasked with clearing a building that has both known enemy combatants and innocent civilians. Armed with rifles that have a selector switch for “Stun” and “Kill,” the platoon can effectively operate in each room they clear more deliberately and more humanely. If they are in doubt, selection of a “Stun” option allows them to remove enemy fighters from the engagement without potentially killing innocent non-combatants. Although they may have intended or preferred to kill the enemy combatants, by stunning them the Marine platoon can at least take the fighters into custody and process them as enemy prisoners of war. Innocent civilians caught in the fight may be temporarily inconvenienced, but they will not suffer permanent effects and will go on to live their daily lives.

Implications

Potential implications related to the development and fielding of a new directed energy weapons capability with non-lethal effects include: doctrine; organization; training; material; and leadership.

Doctrine. No fundamental change to Marine Corps doctrine is necessary to incorporate a new direct energy weapons capability. Marine Corps Doctrinal Publication 1 *Warfighting* states, “The object in war is to impose our will on our enemy. The means to this end is the organized

application or threat of violence by military force.”⁹ A new weapon with both lethal and non-lethal effects is entirely in concert with Marine Corps doctrine and increases the overall warfighting capabilities of the force. Marines participating in future combat operations will remain as lethal as they have always been, but they will also have the ability to accomplish missions employing non-lethal means. Future warfare in the information age will see media prevalence on the modern battlefield as a constant and strategic communications messaging will be vital. Presenting the image of a disciplined Marine force, with state-of-the-art weapons that can be employed with rigid discrimination between enemy fighters and non-combatants, will directly enhance future mission success.

Organization. Each individual Marine will exchange his existing service rifle with a new directed energy weapon in a one-for-one swap; in this case, no organizational changes would be required. The existing organizational structure of the Marine Corps is time-tested and proven under fire. Combat and combat service support formations should not experience any disruption with the incorporation of a directed energy weapon for the individual Marine. For example, an infantry company in 2025 should closely resemble an infantry company today; how Marines conduct training on a new weapon will require changes, but not the structure of the unit.

Training. Changes to training will be the most significant implication relative to development and fielding of new directed energy individual weapons. By arming Marines with a weapon that provides both lethal and non-lethal effects, several changes will have to be incorporated in the training of individuals and units across the Marine Corps. Done properly, these changes will not be excessive and will complement existing training. Currently, Marines are trained on individual skills on both the known-distance (KD) course of fire, as well as in “shoot-no shoot” and “target precedence” engagement scenarios. There are obviously other

training events designed by individual leaders, but the KD course and various engagement scenarios broadly cover the spectrum of training.

A directed energy weapon with lethal and non-lethal effects would eliminate the requirement to use standard ammunition cartridges (i.e. bullets replaced with lethal energy). Because of this, changes to live-fire training must be incorporated. A new target sensing capability will replace scoring a paper target with black and white hit or miss markers. Along with the development of directed energy weapons, an associated target sensor suite should also be fielded. These new target sets should accommodate and score shooter effects based off distance from the target and energy applied at varying ranges (i.e. was the shooter's weapon set to "Stun" or "Kill?"), as well as scoring for old-fashioned accuracy. This new sensor suite can replace the KD course of fire.

A new training suite would also be required to train individuals in updated "decisional engagement scenarios." This requirement can be filled by developing modular, adaptable shoot houses that incorporate numerous engagement scenarios (i.e. shoot – no shoot, close quarters combat, combatants mixed with non-combatants, etc.). The modular shoot houses would need a sensor capability that scored shooters based on their decision making ability relative to the scenario they were presented (i.e. "Stun" vs "Kill" vs "no engagement" and incorporating target precedence from most dangerous to least dangerous). In addition to new shoot houses, expeditionary field target systems will be required. Adapting current individual pop-up targets (e.g. green "Ivan" targets) that sense and react to incoming cartridge rounds from existing weapons to incorporate sensing and scoring directed energy inputs will accommodate this requirement. Both the training shoot houses and new pop-up target sets should be deployable

capabilities that units can embark as part of both peacetime and combat deployments, as well as aboard ship.

Along with new individual training requirements, collective and unit training skills will also have to be updated and enhanced. Non-lethal training scenarios must be developed and incorporated to complement current lethal training scenarios. Mixed scenarios in a complex combat environment must be developed as well. Where a fire team or squad once had to conduct live-fire room clearing in a close quarters environment and only had options to shoot or not shoot, they would now be trained in “Stun” vs “Kill” or both as the situation developed. These new scenarios would require greater unit and self-discipline, as well as a greater understanding of the operating environment by all Marines of the unit. Similar to the development of new tactics, techniques and procedures (TTPs) that are always required with a new weapon or technology, best practices would need to be developed and incorporated into training manuals and Standing Operating Procedures (SOP) throughout the Marine Corps.

Effective and seamless incorporation of a new directed energy individual weapon would require two significant changes to technical training of personnel. New military occupational specialty (MOS) skill training would be required for armorers and weapons maintenance technicians. Additionally, Marine Gunners (MOS: 0306), as the designated infantry weapons experts in the Marine Corps, would require additional training within their professional development. Although all Marines will have assimilation training requirements, weapons maintainers and Marine Gunners will need to thoroughly absorb the new technical and employment aspects of directed energy.

Armorers and maintenance technicians could be trained in existing MOS schools by simply adding a directed energy course of instruction to their existing school program. If the

advent of directed energy weapons proves too cumbersome to incorporate into existing MOS training, an additional MOS could be established for this specific capability. No changes to overall structure would be required, as the newly-trained directed energy weapons maintenance technicians would come from the previously established armorer occupational field (MOS: 21xx).

As the recognized duty experts on the technical and employment aspects of all infantry weapons, Marine Gunners would be required to gain an understanding of the new technology and best practices for employment on the battlefield. Specifically, they would need to assist in training development and determining how to best incorporate this new technology with existing weapons capabilities.

Material. At this time, cost cannot be determined, as the directed energy weapon is not yet developed. However, in terms of sheer numbers, there are currently 230,555¹⁰ variants of the M16 and M4 family of individual weapons in the Marine Corps inventory. Replacing these weapons at their existing cost would be approximately \$274 million.¹¹ While the future cost of a directed energy individual weapon may bear no resemblance to the cost of existing weapons, this figure does provide another basis for comparison. Matched against the cost of one Joint Strike Fighter (\$131 million per aircraft¹²), replacing all existing service rifles in the Marine Corps inventory will be comparatively cheap relative to other expenditures within the Department of Defense.

If developed correctly, the current requirement to shoot standard cartridge rounds can be eliminated. As part of the development of a new directed energy weapon, a light weight “power pack” should be developed to provide the lethal/non-lethal energy source that fuels the weapon. Similar to a rechargeable radio battery, this power pack should be rechargeable and quickly

replaceable (i.e. equivalent to changing magazines during a firefight). Longevity of battery life would need to be balanced against weight and size, but the initial goal for development should be four to six hours usage before requiring recharging or replacing. Solar recharging capabilities should be explored as well to further extend the operational usage of the power pack.

Leadership. Similar to doctrine, no fundamental changes to Marine Corps leadership and education would be required when incorporating a new directed energy weapons capability. A future Marine force armed with both lethal and non-lethal employment options will necessarily enhance the abilities of unit leaders to accomplish designated missions. To that end, all schools and training venues within the Marine Corps, from entry level training to senior-level education, should incorporate seminars and leadership training on when and how to use non-lethal capabilities. Leaders must have an understanding of the capabilities and limitations of the new technology, as well as the proper criterion for determining when to use lethal and non-lethal effects.

Attention must also be paid to psychological factors that may accompany the incorporation of this new weapon. Leaders must ensure the rigid discipline associated with weapons handling procedures in the past continue to be reinforced. Just because a Marine is armed with a non-lethal capability, does not lessen the seriousness of employing his weapon against a human target. There can be no tolerance for firing indiscriminately against non-combatants and Marines should not presume to have a clear conscience by thinking that employment of their weapon in its non-lethal mode is an excuse to relax standards when selecting targets to engage.

Fielding and testing

The Marine Corps Warfighting Laboratory (MCWL), working in concert with Joint Non-Lethal Weapons Directorate (JNLWD), should be given the initial requirement to research and explore development of a directed energy weapons capability for the individual Marine that incorporates both lethal and non-lethal effects. As noted in the Council on Foreign Relations Task Force discussion above, commensurate budget increases must be applied to support the development of non-lethal capabilities. Given that this new weapon proposes to incorporate both lethal and non-lethal effects, additional development dollars from MCWL and other interested agencies can be applied to this effort – not solely JNLWD funds. MCWL and JNLWD, along with the Program Manager for Infantry Weapons Systems, can then partner with defense industry experts to formalize specific technical parameters for development of this new weapons capability.

Once a prototype directed energy weapon has been fielded, testing should be accomplished using a beta group which represents a broad spectrum of occupational fields throughout the Marine Corps; the weapon should be tested by cooks and truck drivers, as well as infantrymen. It should be tested by new recruits with limited training on weapons, as well as competitive shooters on Marine Corps Marksmanship Teams. This testing would either validate existing TTPs or uncover new ones. Items such as recoil effects, integration of optics, conducting power pack changes (vice magazine changes) would all be accounted for. In addition to receiving feedback on the weapon itself, the aforementioned shoot houses and training devices will undergo testing and review as well.

Overwatching all of the development and testing should be a senior mentor panel of Marine Gunners (CWO4-CWO5) with background and experience in previous weapons

development efforts. This senior mentor panel will then be responsible for leading the formalization and required changes to all implications listed above. They should capture all data as training requirements, employment TTPs and best practices are uncovered, and ensure it is incorporated in concert with all other weapons systems into formalized training. Finally, these senior experts should constantly attempt to red team the entire weapons program. They should view the weapon through the eyes of adversaries and attempt to find defeat mechanisms in order to eliminate flaws prior to mass production.

Other applications

If a directed energy weapon is developed for the individual Marine, replacing the existing service rifle and incorporating both lethal and non-lethal effects, this technology will likely have other important applications in future conflict. Police forces can certainly leverage the non-lethal aspect of this new weapon when faced with riot-control and potential hostage rescue situations. There are other military considerations as well. Assuming the new technology from the individual weapon can be applied to crew-served weapons, Marines would enjoy even more flexibility in future combat engagements. Using the example above, Marines clearing a house with known hostile and non-hostile personnel could employ a crew-served weapon in a support-by-fire position using non-lethal machine gun effects. Rather than firing kinetic bullets into a room, non-lethal directed energy can help accomplish the task more humanely.

Conclusion

The United States Marine Corps should research, develop, and field a new weapon that provides both a lethal and non-lethal capability for the individual Marine. Assuming future battlefields will have some resemblance to the irregular warfare situations faced in Iraq and Afghanistan, the individual Marine must be equipped with a better option than the “shoot – no

shoot” scenario that he regularly faces with his current weapon. Developing and fielding a directed energy weapon for the individual Marine that provides both lethal and non-lethal effects is a capability that is needed now and should be technologically possible to achieve.

Future warfare will likely be more complex than previous conflicts. Tactical leaders faced with a cluttered battlefield mixed with hardened enemy fighters, innocent civilians, looters, rioters, and opportunists must be able to draw on a range of weapons capabilities and employ the most appropriate solution to the given situation. Marine Corps Doctrinal Publication 1-0 *Marine Corps Operations* addresses the environment in which Marines will fight, stating, “Marines must consider the impact on the operation by the people and the culture, political and social organization, and any external agencies or organizations that exist within the AO.”¹³ These external factors will often require something other than a lethal solution. Simply put, arming Marines with a non-lethal capability to complement their already deadly skills will make them better, more flexible and highly adaptable in future combat.

Considering other technological advances across the spectrum of warfare, including employment of precision kinetic weapons from unmanned aerial vehicles which are flown by pilots halfway around the globe, developing a more flexible individual weapon must be considered possible and receive a higher priority. Using Active Denial System technology and concepts, directed energy can be applied to the realm of individual weapons development. From this improvement will emerge a more humane and disciplined force, ready for increased challenges on future battlefields.

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